

# A RISK ASSESSMENT FOR SIERRA NEVADA BAT SPECIES UNDER PROPOSED FOREST SERVICE MANAGEMENT ALTERNATIVES

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Seventeen bats were identified as having at least a portion of their range in the Sierra Nevada. Subsequent analysis of population trend, and current and historic distribution identified two species as being highly vulnerable to extirpation, eleven species ranked as moderate vulnerability and 4 species at low vulnerability (Appendix R). The species ranked as high vulnerability are: Townsend's big-eared bat (*Corynorhinus townsendii*), western red bat (*Lasiurus blossevillii*). Each of these species is considered in greater detail below. The remaining species are analyzed individually, where necessary, or in groups using the values for habitat suitability from the California Wildlife Habitat Relationship system (CWHR) and derived utility values (Appendix B). The utility values presented attempt to predict the change in overall habitat suitability between current conditions and the projected vegetation condition 50 years from now for each alternative.

Like many wildlife species bats may utilize distinct habitats to satisfy different life requirements. Bats require roosting habitat, typically found in caves, mines, buildings, trees, snags, and wood or rock piles. Bats forage over water, shrubs, tree canopies, and within riparian areas and forest stands of various ages and structures. Many bats, particularly members of the family Vespertilionidae, require the presence of open water from which to drink. Locating all of the proper habitats within a distance that is energetically affordable is a requirement for all wildlife species and is especially true for volant species such as bats for which travel is energetically expensive. Lack of spatially explicit data on habitat or proposed activities precludes analysis of effects of management on the location and arrangement of habitats used by bats.

Direct effects on bats from the alternatives include habitat modifications that reduce available roost sites through tree or snag removal or destruction of rock outcrops, mines, or abandoned buildings. Disturbance at roost sites can result in total population loss in an area due to the isolation of roost sites across the landscape. Management activities may also result in the alteration of suitable foraging habitat, especially in riparian areas and meadows. Applications of pesticides for insect control can have negative consequences on bat prey availability and can result in the bioaccumulation of toxins in bat tissues leading to reduced survivorship.

## TOWNSEND'S BIG-EARED BAT (*Corynorhinus townsendii*) (California Species of Special Concern, Forest Service Sensitive, High Vulnerability)

1. Current trend or status of the habitat and population.

Townsend's big-eared bat is found throughout California, typically below 6,000 feet in elevation. This bat is most abundant in mesic habitats but may be found in a wide variety of habitats throughout the state including grasslands, riparian areas, desert, and old forest (Zeiner, et al. 1990). Once considered common, Townsend's big-eared bat is now considered to be uncommon in California. The distribution of the species is patchy and associated with limestone caves, lava tubes, and man-made structures such as mines and abandoned buildings (Kunz and Martin 1982). This bat is predicted to occur on 10 of the 11 forests covered by this EIS (CWHR 1999).

Townsend's big-eared bat seems to be primarily a cave or cave-surrogate user (Zeiner, et al. 1990). Townsend's big-eared bats require specific microclimatic conditions to roost successfully. Many caves and mines do not meet these qualifications. This bat is a colonial species that forms maternity colonies of up to several hundred females. Females congregate in March and June with a single pup born between May and July. This bat shows a high degree of roost site fidelity, and, if undisturbed, colonies may occupy the same roost indefinitely (Pierson and Rainey 1998a). Populations of this bat appear to be quite sedentary with movement to alternate roosts confined to within 15 kilometers of the primary roost. Townsend's big-eared bat is very sensitive to disturbance at roost sites and may abandon a roost once disturbed (Graham 1966, Humphrey and Kunz 1976). Disturbance at maternity colonies may also impact adult survival and reproductive success (Brigham and Fenton 1986).

Foraging habitat for Townsend's big-eared bat is varied but the species forages preferentially over native vegetation. Habitat associations include desert, native prairies, coniferous forests, mid-elevation mixed conifer, mixed hardwood-conifer forests, riparian, communities, and active agricultural areas (Kunz and Martin 1982, Zeiner, et al. 1990). This bat feeds principally on moths but may take other insects as well (Kunz and Martin 1982). These aerial foragers concentrate their activity along forested edges and over vegetation. This species requires access to free water.

Townsend's big-eared bat has suffered a substantial decline in population over the last 40-60 years (Pierson and Rainey 1998a). Two of the Midwestern and Eastern subspecies of *C. townsendii* have been listed under the Endangered Species Act. Surveys conducted in California at historical maternity roosts (located prior to 1980) revealed that 24 of 46 sites (52 percent) were no longer occupied (Pierson and Rainey 1998a). Nearly 40 percent of the known sites had been destroyed or rendered unusable. In addition, Pierson and Rainey found a 55 percent decline in the number of females present in the extant populations. In the Mother Lode region of the Sierra Nevada, the mean colony size has decreased from more than 200 individuals to 47 (Pierson and Rainey 1998a). The authors suggest that the main threat leading to the decline of this species in California is human presence.

## 2. Key threats

### A. FS-HABITAT RELATED THREATS

### Roosting habitat

Given the requirement of a specific environment and this bat's sedentary behavior, it is likely that Townsend's big-eared bat is limited by roost site availability. Although natural deterioration of caves and mines is to be expected, the majority of roost loss found by Pierson and Rainey (1998a) was related to human activity: disturbance, demolition, renewed mining, hazard abatement, or vandalism. The increased interest in recreational caving has led to an increase in risk for all cave and mine roosting bats. One of the primary centers of distribution for Townsend's big-eared bat is the Mother Lode of the Sierra Nevada with its limestone cave formations and old mine workings (Pierson and Rainey 1998a). This area is predicted to have one of the highest human population growth rates in the Sierra Nevada (SNEP 1996). There have been significant declines in populations of Townsend's big-eared bat in this area and this trend will likely continue if published human population growth projections are realized.

Inactive mines provide an important analog to cave habitat for many bat species (Pierson and Rainey 1998a). Safety concerns have led to mine closure programs in many areas often without adequate consideration of the biological value of old mines. Closure at the wrong time of year can eliminate entire colonies. Many old mine workings have been destroyed to make way for larger pit mine operations that have little value as roosting habitat. Caustic chemicals, such as cyanide, may be used in ore extraction and waste pond containing these substances pose a threat to wildlife. Clark and Hothem (1991) found that bats accounted for 34 percent of documented wildlife fatalities.

Townsend's big-eared bat seems to respond readily to protections at roost sites as long as some individuals remain in the local area. When roost sites that have been abandoned are gated properly to prevent human intrusion bats often reoccupy the site within a relatively short period of time (Pierson and Rainey 1998a). Gates placed at occupied roosts often result in an increase in population size.

### Foraging Habitat

Modification of foraging habitat may also pose a risk to Townsend's big-eared bat. Conversion of habitat to vineyards and loss of riparian habitat has been implicated in the decline of a number of bat species (Pierson and Rainey 1998a). The impacts of logging on Townsend's big-eared bat have not been investigated. For many other species with similar foraging behavior, loss of habitat openings in which to forage may be a problem.

Loss of foraging habitat may be important in some areas but in general Townsend's big-eared bat seems to be an opportunistic feeder (Pierson and Rainey 1998a) capable of utilizing a variety of open habitats for foraging (CWHR 1999).

## B. OTHER OFF-FS LAND THREATS OR SUBSIDIES

As noted above, Townsend's big-eared bat requires adequate habitat remote from human disturbance. Urbanization may have caused population declines along the Colorado River (Pierson and Rainey 1998a) and in other areas. Certainly, where bats roost in proximity to

humans there is often a negative consequence for the bat. Pest control of bats in buildings is a lucrative business. Although known primarily as a cave species, Townsend's big-eared bat will occasionally take up residence in buildings. Unlike other bats that roost in crevices, Townsend's big-eared bat roosts in the open on ceilings and walls, making it relatively easy to detect (Pierson and Rainey 1998a).

Thirteen of the largest known colonies of TBEB occur on public land. Of these 6 occur in the National Parks, 4 occur on forest service land, and 1 on BLM land. Currently the colonies within the National Parks receive the greatest protection from human disturbance (Pierson and Rainey 1998a) through gating, structural modifications and education.

### C. EXTENT TO WHICH CURRENT FS-HABITAT RELATED THREATS CONTRIBUTE TO THE CURRENT TREND OR STATUS OF THE HABITAT AND POPULATION

Townsend's big-eared bat has specific structural and non-structural roost site requirements. Few caves or mines will satisfy the former requirement. The single most important non-structural component of roost sites for this species is absence of human disturbance. The increase in human population in California and the increase in recreational caving are the biggest threats to the persistence of this bat in the Sierra Nevada. The use of Forest Service land by recreationists falls under the authority of the Forest Service. The agency has control over the type and timing of human activity. It is difficult to determine the level of responsibility the Forest Service bears for the historic decline of Townsend's big-eared bat. Scientific collection, extermination in human habitations and vandalism have all played a role. Certainly, the failure to regulate mining to protect old mine workings and lack of a comprehensive conservation approach for bats in general has played a role.

### 3. INFLUENCE OF PROPOSED MANAGEMENT ACTIVITIES ON HABITATS & THREATS BY ALTERNATIVE.

Because of its close association with caves and cave-analogs, Townsend's big-eared bat is not a good candidate for analysis using CWHR vegetation projections except for general changes to potential foraging areas. There is no treatment of recreational caving in the EIS so the analysis of effects on roost sites is based on the treatment of mines and mining. Withdrawal of areas from mining activities is assumed to be beneficial, as it would reduce the level of human disturbance, road building, and the rate of re-entry into old mines. Road building to support mining activities can disrupt foraging habitat and improve access to caves and mines for recreational cavers. A trade-off may exist between disturbance and the potential for new roost site generation through mining. However, the majority of recent mines are pit mines that provide little value as roost sites. Given this and the high sensitivity of this species to disturbance, new mine construction is assumed to be detrimental.

#### Mines and Mining

The following is based on the analysis of the alternatives presented in Appendix M.

#### Alternative 1:

No change from the current management of mining activities. Mining activities are evaluated as an ongoing process. No new mineral withdrawals. This alternative represents a risk to the species, as it would continue to allow mining activities although the rate of re-entry into old mine workings is not known.

#### Alternatives 3, 4, and 7:

These alternatives are similar to Alternative 1 in that they do not propose new mineral withdrawals. They differ in the number of claims restricted by the alternative. Alternative 3 has the most, Alternative 7 has the least, and Alternative 4 has an intermediate value.

However, these differences are not substantial. All of these alternatives would have consequences similar to Alternative 1.

#### Alternatives 2, 5, 6, 8:

These alternatives propose new mineral withdrawals. Alternative 2 would withdraw up to 75 percent of the Sierra Nevada Known Mineral Deposit Areas (KMDA) and 78 percent of active claims. Alternative 5 propose withdrawal of up to 45 percent of KMDAs and 40 percent of active claims. Much of the withdrawals proposed are in unroaded areas > 1000 acres. Alternatives 6 and 8 propose withdrawal of up to 11 percent of the KMDAs and 9 percent of active claims.

#### Summary of consequences:

Since it proposes the greatest level of withdrawal Alternative 2 should pose the least risk to TBEB. Alternative 5 would withdraw KMDAs within unroaded areas > 1000 acres. If these areas overlap the distribution of TBEB this would reduce the risk of human disturbance for the species. Alternatives 3, 4 and 7 are slightly less risky than Alternative 1 as they would restrict mining activities on some claims. Alternatives 1, 3, 4, and 7 pose the greatest risk for re-entry of old mines and disturbance caused by new mine and road construction.

#### Foraging habitat:

According to CWHR, Townsend's big-eared bat prefers to forage in and along blue oak woodland, Sierra mixed conifer, and white fir stands with <40 percent canopy closure and over sagebrush. Townsend's big-eared bat will also forage in riparian and meadow areas. Based on the utility values derived from CWHR suitability indices, Townsend's big-eared bat habitat suitability will decline an average of 2.4 percent. As discussed elsewhere (Appendix B), these values are most accurate for conifer and montane hardwood habitats and are not applicable to shrub, riparian or meadow habitats. Townsend's big-eared bat prefers to forage in areas that have less than 40 percent canopy closure. According to vegetation projections, stands in the structure classes 3S, 4S, 4P, 5S and 5P are predicted to decrease 12 (Alternative 4) to 24 percent (Alternative 2). All alternatives show a shift from sparse canopy (10-24 percent canopy closure) to open canopy (25-39 percent canopy closure) stands in all size classes. In hardwood areas, many alternatives require retention of at least 40 percent canopy closure. Loss of open habitat is assumed to be a risk to the foraging areas preferred by TBEB.

Alternative 1 has few canopy retention standards and the most flexible standards and guidelines. Alternatives 2, 3, 5, 6 and 8 would not allow reduction of canopy below 40 percent in any hardwood stand. These alternatives also show the greatest rates of decrease in sparse and open stands combined (18-24 percent) according to the vegetation projections, and exhibit a marked shift from sparse to open conditions. Alternatives 4 and 7 maintain a variety of canopy classes at the watershed scale and would retain 40 percent of hardwood stands in early to mid-seral condition. The two lowest changes in suitability for TBEB occur under these two alternatives. Alternatives 1, 4, and 7 should represent the lowest risk to open canopy stands preferred by TBEB for foraging.

**Table 1:** Predicted percent change in CWHR habitat suitability values for Townsend's big-eared bat

<b>Alternative</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Townsend's big-eared bat	-2.2	-4.0	-3.4	0.7	-3.2	-2.6	-1.1	-3.2

#### D. SUMMARY OF CONSEQUENCES TO TOWNSEND'S BIG-EARED BAT

The Townsend's big-eared bat has experienced a drastic population decline in California and many historically occupied sites have been destroyed (see references above). The importance of caves and mines and freedom from human disturbance cannot be overstated for this species. However, providing adequate roosting habitat is not adequate if appropriate foraging habitat is unavailable or inaccessible for this relatively sedentary species. Lack of spatial data prevents a thorough analysis of these issues. Finally, human disturbance, primarily through recreational caving, poses a continuing threat to the persistence of Townsend's big-eared bat in the Sierra Nevada.

Alternative 2 provides the best protection for roosting habitat in mines. Alternative 2 does not provide well for foraging habitat, as it would prevent canopy reduction below 40% in any hardwood stand. Vegetation projections indicate a 4% reduction in habitat suitability over 50 years under this alternative. While this seems a small percent change, for a single habitat component (foraging habitat) for a species already in decline, this may represent a more substantial impact. In addition, the vegetation projections may not be able to adequately portray the changes in the habitat types preferred by this species. Consequently, the actual change in suitability over time may be smaller or greater. Alternatives 4 and 7 provide for foraging habitat by ensuring the presence of a variety of stand types on the landscape. None of these alternatives can be perceived as low risk to the persistence of Townsend's big-eared bat. Only an alternative that combines protection of existing mine workings and prevention of the disturbance associated with new mines, coupled with the vegetation management required to provide a diversity of canopy closures on the landscape will approach the type of management needed for this species. Even such a combined alternative may not provide for the persistence of Townsend's big-eared bat unless it also addresses the issue of recreational caving in areas important to the species.

#### WESTERN RED BAT (*Lasiurus blossevillii*)

(California Species of Special Concern, Forest Service Sensitive, High Vulnerability)

1. Current trend or status of the habitat and population.

The western red bat is locally common in some areas of California, occurring from the Mexican border northwards along the western slope of Sierra Nevada up to Shasta County (Zeiner, et al. 1990). It is a summer resident, and is known to winter in coastal California. Because red bat populations are scattered, it is considered rare throughout the state.

The red bat is found near forests where shade trees are present. The red bat is found primarily in riparian and wooded habitats in deciduous trees such as oaks, willows, cottonwoods, and sycamores (Bolster 1998). This solitary species roosts almost exclusively in large shrubs and trees, with roost sites typically 3-20 feet above the ground in dense foliage (van Zyll de Jong 1985). Roost sites occur in foliage dense enough to hide the bat from view in all directions except from below, which allows the bat to drop downward to fly (Bolster 1998). Roost sites usually have dark ground cover, and at least one red bat was discovered roosting in the leaf litter on the ground (IBID). Roosting habitat may be found in areas bordering forests and woodlands, rivers, cultivated fields, and urban vicinities from sea level to 3,000 feet in elevation (Zeiner, et al. 1990). The Arizona Department of Fish and Game ([www.gf.state.az.us](http://www.gf.state.az.us)), includes fruit orchards as roost sites, and notes that foraging usually occurs within 1,000 yards of roosts. It appears that habitat consists of sparse to open canopy supporting individual trees with dense foliage to provide an intermix of foraging/commuting and roosting habitat. Additionally, the red bat requires access to drinking water, as it is a poor urine concentrator.

2. Key threats

A. FS-HABITAT RELATED THREATS

Roost Sites

The western red bat roosts primarily in trees (willows, cottonwoods, and sycamores) not specifically addressed or protected by Forest Service management. Vegetation modifications such as prescribed or wildfire that would open up the foliage in a roost tree up to 20 feet in height could have a direct effect on use of that site.

Management that alters riparian habitats may have a direct beneficial or detrimental effect on the red bat.

Foraging Habitat

Management of riparian areas to increase canopy cover could constitute a barrier to effective commuting and foraging flight. Another potential direct effect is loss of foraging areas above low elevation wet meadows due to the effects of fire suppression, allowing trees and shrubs to encroach on these important insect-producing sites.

The use of pesticides to control insects poses another threat, especially in proximity to meadow or riparian areas. Pesticides from ingested insects concentrate in bat fat, expressing

the strongest negative effects in migratory and hibernating species that undergo extensive metabolization of stored fat reserves (little browns--Kunz, et al. 1977)). This can lead to lowered individual fitness and even death. Additionally, use of pesticides for insect control causes localized reductions in their availability as prey for the bat.

## B. OTHER OFF-NFS LAND THREATS OR SUBSIDIES

The bulk of the California distribution of the western red bat occurs below NFS lands. This area has lost much of the native riparian and hardwood habitats to urbanization and agricultural development.

### Roost Sites

As streams have been extensively channeled into irrigation ditches to support the agricultural industry prevalent at lower elevations where the bulk of the red bat habitat exists, there has been a reduction in riparian vegetation available to support roosts. Urbanization has further resulted in loss of trees for roost sites.

### Foraging Habitat

The interspersed trees with open areas has generally been lost in the conversion of foothill habitats to vineyards. Urbanization has resulted in the loss of foraging areas, especially in the form of wet meadows, to housing and associated development.

## C. EXTENT TO WHICH CURRENT NFS-HABITAT RELATED THREATS CONTRIBUTE TO THE CURRENT TREND OR STATUS OF THE HABITAT AND POPULATION

Due to a general lack of information on this species, we cannot assess the contribution of NFS management to population or habitat trends at this time. However, little NFS land in the Sierra Nevada occurs at or below 3000 feet in elevation. It therefore seems that the risk of deleterious effects to the amount and distribution of habitats or populations as a result of NFS activities is small.

## 3. INFLUENCE OF PROPOSED MANAGEMENT ACTIVITIES ON HABITATS & THREATS BY ALTERNATIVE.

Solitary roosters such as the western red bat are at less risk of population level impacts resulting from a single management activity than are colony-forming species like Townsend's big eared bat.

At the stand scale, bat activity is related to the availability of foraging and roosting resources (Erickson and West 1996, Barclay and Brigham 1996). Since clearings were found to have higher insect abundance than surrounding forests (Lunde and Harestad 1986), use by foraging bats is expected. Indeed, the red bat requires open areas to forage. Activities that create sparse to open canopies such as fire and thinning of older stands in proximity to

riparian areas are assumed to favor the species, provided the foliage density required for individual roost sites is not compromised.

At the landscape scale, the abundance and distribution of large, densely-foliated trees will determine roost availability and bat use depending upon the distances between roost, forage, and drinking sites (Erickson and West 1996, Barclay and Brigham 1996). CWHR habitat utility values may be used to arrive at an overall assessment of habitat over a 50-year implementation period.

**Table 2:** Predicted percent change in CWHR habitat suitability values for Western Red Bat

<b>Alternative</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Percent Change	- 2.0	- 1.1	- 1.1	- 2.3	- 1.2	- 0.4	- 1.6	- 1.6

A change of  $-1$  to  $+1$  percent is so small, it is perceived as neutral. A negative change of between 1 and 10 percent is considered a small decrease in habitat suitability. Alternatives 1 and 4 show the greatest negative change, but the magnitude of the change barely exceeds neutral. Alternative 6 shows the least decline, while the others cluster in between.

#### Roost Sites

Roosting habitat may be found in edge areas bordering forests and woodlands, rivers, cultivated fields, and urban vicinities. Deciduous trees are required for roosting in relatively open-canopied riparian areas. There is a risk that fires with flame heights of 3 feet or above could affect foliage density in established roost trees. The risk of fire in riparian habitats is somewhat balanced by this need for relatively open canopy with large trees.

Alternative 1 has no provisions for conservation or restoration of hardwood roost trees, and no active riparian or meadow restoration (which all other alternatives accomplish to some degree), which will carry more risk for the species. Alternative 2 conducts the least amount of prescription fire resulting in minimal risk of fire affecting foliage density in established roost trees, but this strategy also results in increased riparian canopy closures and risk of stand-replacing wildfire. Alternative 7 emphasizes mechanical treatment in Alternatives 3, 5, 6, and 8 require assessment of hardwoods in a landscape/watershed analysis, providing opportunity to ensure adequate consideration of the habitat needs of this bat at low elevation sites. Alternatives 3 and 4 conduct the greatest amount of prescribed fire in meadow and riparian areas.

#### Foraging Habitat

Alternatives 3, 5, 6, and 8 require maintenance of at least 40 percent canopy closure where mechanical treatments are applied. This may result in a shortage of foraging habitat, particularly in riparian areas. Alternative 2 also limits cover reductions beyond 40 percent in any hardwood stand, so the creation of early seral open-canopy conditions will occur primarily as a result of stand replacing wildfire. Alternative 4 creates a large amount of open canopied habitats as a result of the highest amount of prescription fire, but individual roost sites may be susceptible to foliage reductions. Alternative 7 creates the largest amount of

open canopied habitats as a result of mechanical treatments, which should bear less risk than fire to dense foliage in individual trees not harvested.

Pesticide use is limited adjacent to riparian areas in most alternatives as follows. Alternative 1 has no limitations except statements in most forest LRMPs to maintain riparian areas. All alternatives prohibit pesticide application within 500 feet of known occupied sites of two lower elevation frogs: California red-legged and foothill yellow-legged. Alternative 2 goes the furthest to reduce the risk by prohibiting pesticide application in all historic habitats of these frogs. Alternatives 3 and 5 prohibit pesticide application in all habitat of these frogs occupied in the past 25 years, a smaller area than that covered in Alternative 2. Alternatives 4, 6, and 7 make no further provisions, thus having more risk than other alternatives with the exception of 1. Alternative 5 avoids application of pesticides in all riparian areas, while providing for a few TES species-related exceptions, thus carrying the least risk of any alternative. Alternative 8 prohibits application of pesticides to livestock in all riparian areas, although it fails to address application to vegetation.

#### D. SUMMARY OF CONSEQUENCES TO WESTERN RED BAT

The western red bat is considered well distributed throughout California but may be locally rare. The CWHR-derived utility values indicate an essentially neutral change in habitat suitability across the proposed alternatives. However, the utility values do not address riparian and meadow habitats. Alternatives that provide for large deciduous trees along forested edges and in riparian areas for roosting habitat, foraging habitat and a low risk from pesticides will be the most beneficial to this species and will likely ensure its persistence in the Sierra Nevada.

As for the Townsend's big-eared bat above, no single alternative addresses all the needs of the western red bat. The focus of most alternatives is the generation of large trees and closed canopy forest. Only Alternatives 4 and 7 provide the open habitat and the diversity of habitat that would provide edge habitat and foraging habitat for western red bats. However, Alternatives 4 and 7 are more risky for meadows and riparian areas and do not provide protections from pesticides. In particular, Alternative 4 is risky for foliage at existing roost trees due to the emphasis on prescribed fire in this alternative. Alternative 7 provides the best combination of roost and foraging habitat. Alternatives 2 and 5 represent the lowest risk from pesticide applications in riparian and meadow areas. An alternative that combined the attributes of these 3 alternatives would be the lowest risk to western red bats.

#### MODERATE AND LOW VULNERABILITY SPECIES

The remaining fifteen bat species are grouped based on their primary roost type affinities as constructed by the Western Bat Working Group (1998). These groupings are shown in Table X. Since the majority of insectivorous bats are opportunistic foragers (Fenton and Barclay 1980), it is likely that bat populations are more often limited by roost site availability rather than prey availability. Three species of bats roost primarily in cliffs; two species use trees;

and the remaining ten species use multiple roost types. The bat species with more specialized roost site requirements also tend to be the species at greatest risk.

#### Cliff-roosting bats

Three bat species in the Sierra Nevada fall into this group: the western mastiff bat (*Eumops perotis*), the spotted bat (*Euderma maculatum*), and the western pipistrelle (*Pipistrellus hesperus*). Of all the bats species considered here, the western mastiff bat shows the greatest predicted decline in habitat suitability, and is the only species to have predicted declines in excess of 10 percent.

**Table 3.** Bat species groupings by roost site affinity. SNFP vulnerability codes: H = high; M = moderate; L = low.

Species	SNFP Vulnerability	Multiple Habitats	Tree-roosting	Cliff-roosting	Cave-Roosting
<b>Townsend's big-eared bat</b>	H				X
<b>Western red bat</b>	H		X		
<b>Hoary bat</b>	M		X		
<b>Silver-haired bat</b>	M		X		
<b>Pallid bat</b>	M	X			
<b>Spotted bat</b>	M			X	
<b>Western mastiff bat</b>	M			X	
<b>Brazilian free-tailed bat</b>	M	X			
<b>Small-footed myotis</b>	M	X			
<b>Long-eared myotis</b>	M	X			
<b>Little brown bat</b>	M	X			
<b>Fringed myotis</b>	M	X			
<b>Long-legged myotis</b>	M	X			
<b>California myotis</b>	L	X			
<b>Yuma myotis</b>	L	X			
<b>Big brown bat</b>	L	X			
<b>Western pipistrelle</b>	L			X	

#### WESTERN MASTIFF BAT (*Eumops perotis*)

(California Species of Special Concern, Moderate vulnerability)

The western mastiff bat, the largest bat in North America, is distributed in the southern portion of the state, occurring in the central and southern regions of the Sierra Nevada (Pierson and Rainey 1998b). This species is found primarily in the large river drainages with the largest populations found below 2400m. The distribution of the western mastiff bat is likely driven by roost site availability. Appropriate roost sites are typically found in crevices in exfoliating granite, sandstone and basaltic cliffs (Kruttsch 1955). Only a fraction of available of crevices will satisfy the roosting requirements for this species. Because of its large size the western mastiff bat requires relatively larger crevices than the other cliff roosting species. Due to its wing morphology, which is adapted to long fast flight, this bat

requires limited to no vegetation cover in proximity to the roost entrance to facilitate entry and a vertical drop of at least 2-3m below the entrance in order to attain flight (Best, et al. 1996). Mastiff bats roost together in small groups of up to 100 individuals. Habitat types associated with roost sites range from scrub to oak woodland, ponderosa pine and mixed conifer forests.

There is little historical data available for this species. Recent survey efforts with improved techniques have enabled researchers to extend the distribution of this species in the Sierra Nevada. Without historic data it is difficult to access population trend.

The western mastiff bat historically foraged over wet marshy areas in the Central Valley and the Sierra foothills (D. Williams pers comm.). Much of this habitat has now been lost to urban and suburban development. Pierson and Rainey (1998b) found mastiff bats foraging high (up to 300m above the ground) over broad open areas. According to CWHR, wet meadows have high foraging value for this species. Other habitats have some value as long as the canopy closure does not exceed 24 percent (CWHR 1999). Given these specific requirements, management activities that threaten roost site availability, meadow and riparian health, and areas of low canopy closure represent greatest risk to this species. The fact that this species is colonial increases the risk to local populations from management activities.

#### Roost sites

Activities that could threaten roost site availability include: (1) urban and suburban expansion, especially when such developments are in close proximity to rock outcrops; (2) water impoundment; (3) destruction of cliff faces for road construction; (4) Cliff destruction for mine or quarry operations; (5) recreational climbing; and (6) human disturbance (Pierson and Rainey 1998b). Of these threats, the USFS has management control only over the last three as they occur on Forest Service lands.

Mining and quarry operations may damage or destroy roosting habitat. In addition, some extraction techniques utilize cyanide that may persist in toxic pools at some sites. These pools pose a significant risk to mastiff bats that require large pools of standing water from which to drink.

See the discussion of mining in the section on Townsend's big-eared bat for a complete discussion of alternatives. Since it proposes the greatest level of withdrawal Alternative 2 should pose the least risk. Alternative 5 would withdraw KMDAs within unroaded areas > 1000 acres. If these areas overlap the distribution of the western mastiff bat this would reduce the risk of disturbance for the species. Alternatives 3, 4 and 7 are slightly less risky than Alternative 1 as they would restrict mining activities on some claims. Alternatives 1, 3, 4, and 7 pose the greatest risk for re-entry into old mine sites and disturbance caused by new mine and road construction.

#### Recreation and Human disturbance

Increased interest in outdoor recreation has led to an increase in recreational climbing in traditional climbing areas, such as in Yosemite National Park, and an expansion into foothill

areas where recreational climbers may disturb roosting mastiff bats or cause degradation or destruction of available roost sites. These activities are not controlled under any alternative.

#### Foraging areas

Foraging habitat is most at risk from activities that threaten meadow and riparian habitat and would increase canopy closure. The effects of management activities, including grazing, on meadow insect productivity are not well documented. Alternatives 2, 5, 6, 7, and 8 would seem to represent the least risk to meadow and riparian habitat and insect productivity by limiting grazing impacts. Alternatives 3 and 4 use the highest level of fuels treatment and would be most beneficial in maintaining open habitat in riparian areas. Alternative 2, which maintains fire suppression as a fire control method, poses an increased risk to open canopy riparian areas by allowing encroachment. Meadow and riparian attributes are not well-represented in the utility values.

Mastiff bats are intolerant of canopy closures greater than 24 percent. Most alternatives seek to increase canopy closure in both hardwood and conifer stands to at least 40 percent and in most cases 60 percent. Consequently, there is a decline in sparse habitat (less than 24% canopy closure) under most alternatives ranging from 18-44 percent. Only Alternatives 4 and 7 would generate habitat with canopy closure less than 24 percent. Consequently, these two alternatives produce the lowest predicted loss of suitability for mastiff bats, 4 and 10 percent respectively. Alternative 4 is the least risky alternative for the mastiff bat.

#### SPOTTED BAT (Euderma maculatum)

(California Species of Special Concern, Moderate Vulnerability)

As for the western mastiff bat, the occurrence of the spotted bat appears to be related to roost structure, roost availability, and proximity to a permanent water source (Priday and Luce 1999). The roost requirements for the much smaller and more maneuverable spotted bat are likely not as restrictive as those for the western mastiff bat. Although broadly distributed, populations are patchy. This species is thought to be one of the rarest bats in North America and is considered uncommon through out its range (CWHR 1999). Rarity, an uneven distribution, and the somewhat restrictive roosting requirements of this species place it at risk (Pierson and Rainey 1998b).

The spotted bat is found widely distributed in the central and southern Sierra Nevada with the greatest concentrations between 1200-1400m elevation (Pierson and Rainey 1998b). The spotted bat is typically found in mixed conifer-hardwood habitat and frequently forages over or adjacent to meadows below cliffs of sandstone, granite or basalt. While this species has similar requirements to the mastiff bat, it may exploit a broader range of roosting and foraging sites due to its smaller size and greater agility. In addition, the spotted bat does not appear to form colonies, reducing the potential for impacting an entire population. Consequently, while the spotted bat is likely effected by the same activities as described for the mastiff bat above, it would be expected to experience them to a lesser degree. The predicted change in suitability for this species over 50 years ranges from 0.8 to -1.2 percent with a mean predicted change of -0.4. In general, the alternatives have a neutral effect on habitat suitability for the spotted bat. As for the western mastiff bat, the canopy-opening

alternatives, Alternatives 4 and 7, are the least detrimental and actually show a slight positive impact on habitat suitability for this species (0.9 and 0.8 percent respectively) although the overall impact is still considered “neutral”.

#### WESTERN PIPISTRELLE (Pipistrellus hesperus)

(Low vulnerability)

The western pipistrelle is the smallest of the cliff-roosting species. This relatively common bat is associated chiefly with rocky situations along watercourses. Its daytime retreat is in cracks and crevices of canyon walls or cliffs, under loose rocks, or in caves. It is most commonly associated with arid, low elevation habitats but may extend into woodlands and up to mixed conifer habitats (CWHR 1999). It forages at low to moderate heights primarily over water and along water courses and cliff faces. It is an opportunistic foraging, feeding on a wide variety of small insects.

Much of this bat’s range falls outside the domain of this document. The portion of the range that occurs in the affected area is unlikely to be significantly impacted by proposed management activities. This species, while tied to geomorphic features for appropriate roost sites, is widespread, occupying a variety of habitats and preying upon a wide array of insects. It is unlikely that the proposed activities will have a significant impact on this species. The projected change in suitability ranges from 0.8 to –1.2. The pattern of the changes across alternatives indicates the most positive impact from Alternatives 4 and 7, likely due to the creation and maintenance of open habitats for foraging.

**Table 4:** Predicted percent change in CWHR habitat suitability values for cliff roosting bats.

Species	Alternative							
	1	2	3	4	5	6	7	8
Western mastiff bat	-12.0	-17.8	-13.1	-3.9	-11.5	-13.4	-10.1	-11.4
Spotted bat	-0.9	-0.8	-0.9	0.9	-0.8	-0.7	0.8	-1.2
Western pipistrelle	-0.9	-0.9	-0.9	0.8	-1.0	-0.8	0.9	-1.2

#### Tree-roosting bats

In addition to the western red bat discussed above, two species are associated with tree roosts: the hoary bat (Lasiurus cinereus) and the silver-haired bat (Lasionycterus noctivagans). Both of these species are ranked as moderate vulnerability and both have a mean decline in habitat suitability of –2.4 percent.

#### HOARY BAT (Lasiurus cinereus)

(Moderate vulnerability)

The hoary bat is considered the most widespread of American bats (Shump and Shump 1982). It may be found from sea-level to over 4000m elevation, from shrub habitat to hardwood and conifer forests. The hoary bat is a solitary, foliage roosting species. Its cryptic coloration allows it to blend in with dead leaves or bark. It tends to roost along forest edges and in riparian zones, in areas of medium to large trees where individual trees have dense

foliage (CWHR 1999). Habitats where hoary bats are found tend to have an open or mixed canopy condition (Shump and Shump 1982).

Hoary bats forage in open areas along forest edges, above the forest canopy, and in meadow and riparian areas (CWHR 1999, Kalcounis, et al. 1999, Shump and Shump 1982). Foraging may be associated with older forest conditions and degree of canopy closure. In Ontario, Canada, Jung et al. (1999) found hoary bats in old-forest stands more often than in logged stands and stand use was related to the presence of open canopy conditions. According to CWHR (1999), hoary bats find high suitability in conifer and hardwood stands with trees greater than 11" dbh and with canopy closure less than 40 percent. Hoary bats, like western red bats, feed on a small number of insect species, primarily moths, and may be considered dietary specialists (Shump and Shump 1982).

Alternatives that lead to a reduction in potential roost sites or loss of open canopy habitats will have a negative impact on hoary bats. All alternatives retain large conifers and hardwoods at a sufficient level as to represent low risk to this habitat element over time. Alternative 8 represents the lowest risk to large trees by providing retention and recruitment of large trees and an adaptive framework for the implementation of vegetation treatments including prescribed fire.

The risk of fire in riparian habitats is somewhat balanced by the need for relatively open canopy with large trees. Alternatives 3 and 4 use the highest level of fuels treatment and would be most beneficial in maintaining open habitat in riparian areas. Alternative 2, which maintains fire suppression as a fire control method, poses an increased risk to open canopy riparian areas by allowing encroachment. Meadow and riparian attributes are not well represented in the utility values.

Alternatives 4 and 6 will pose the least risk to hoary bats from canopy increase as these alternatives propose substantial fuels reduction treatments focused in the mid-elevation hardwood, hardwood-conifer and mixed conifer forest types. Alternative 4 is the more aggressive in this regard, as it would create DFPZs and strategic area fuels treatments, large blocks of habitat with 40 percent canopy closure. Unfortunately, both these alternatives emphasize the use of prescribed fire, which may pose a risk to dense foliage used as roost sites. Alternative 7 creates the largest amount of open canopied habitats as a result of mechanical treatments, which should bear less risk than fire to dense foliage in individual trees not harvested. Alternatives 2, 3, 5 and 8 require maintenance of at least 40 percent canopy closure where mechanical treatments are applied and would pose a greater risk of canopy closure in excess of that favored by hoary bats.

The hoary bat prefers areas with large trees and will tolerate a greater level of canopy closure than the western mastiff bat and as a consequence, will be less affected by the proposed alternatives. The projected change in habitat suitability for this species ranges from -1.5 to -3.3 percent with the lowest decline found with Alternatives 4 and 6.

**SILVER-HAIRED BAT (Lasionycterus noctivagans)**  
(Moderate vulnerability)

The silver-haired bat is a widely distributed bat that is erratic in abundance (Kunz 1982). In the summer in California it may be found in any forested habitat below 2700m (CWHR 1999). This species roosts in tree cavities, in crevices and under exfoliating bark. Roost trees are large in diameter and in early to middle stages of decay (Campbell et al. 1996, Vonhof 1996). Roosts are frequently in areas of low canopy closure or adjacent to openings (Campbell et al. 1996).

Silver-haired bats typically forage in or near coniferous and/or mixed deciduous forests adjacent to ponds or other sources of water, usually within 6m of the ground. When foraging within a stand, this species is more often found in canopy gaps or in the subcanopy than in the canopy (Jung, et al. 1999). Silver-haired bats find high quality habitat in stands with large trees (> 11" dbh) and an open canopy (>40 percent) (CWHR 1999). As with most other insectivorous bats, this bat is opportunistic in its feeding habits and takes a wide variety of small to medium-sized insects.

Alternatives that reduce snag abundance or lead to an increase in canopy closure will have a negative impact on silver-haired bats. Alternatives 2, 5 and 8 pose the least risk to snag retention and recruitment over time. Alternative 5 would provide for the retention of up to 8 of the largest snags/ acre. Alternatives 2 and 8 would retain 4/acre. Alternatives 3 and 4 pose the greatest risk to snags by potentially reducing snags to 0-2/acre.

As indicated above, the risk of fire in riparian habitats is somewhat balanced by the need for relatively open canopy and large snags. Alternatives 3 and 4 use the highest level of fuels treatment and would be most beneficial in maintaining open habitat in riparian areas but could pose a substantial risk to snags. Alternative 2, which maintains fire suppression as a fire control method, poses an increased risk to open canopy riparian areas by allowing encroachment.

Alternatives 4 and 6 will pose the least risk from canopy increase as these alternatives focus fuels reduction treatments in mid-elevation forest types. Alternative 4 is the more aggressive in this regard, as it would create DFPZs and strategic area fuels treatments, large blocks of habitat with reduced canopy closure. Unfortunately, both these alternatives emphasize the use of prescribed fire, which may pose a risk to snags. Alternative 7 creates the largest amount of open canopied habitats as a result of mechanical treatments and would pose less of a risk to snags. Alternatives 2, 3, 5 and 8 require maintenance of at least 40 percent canopy closure where mechanical treatments are applied and would pose a greater risk of excessive canopy closure.

**Table 5:** Predicted percent change in CWHR habitat suitability for tree-roosting bats.

	<b>Alternative</b>							
<b>Species</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Hoary bat	-2.4	-3.3	-2.8	-1.5	-2.5	-1.6	-2.5	-2.7
Silver-haired bat	-2.4	-3.6	-3.3	-1.0	-2.4	-1.5	-2.1	-3.0

## Bats using multiple roost types

Ten bat species utilize multiple roost types. These species may be found roosting under exfoliating bark, in cracks or crevices, in caves, mines or buildings. Foraging areas vary by species and are grouped as follows: Low Elevation, Hardwood, Shrub, and Grassland Group; Conifer, Conifer-Hardwood Group; and Broad Elevational Distribution and Habitat Generalist Group. All species utilize riparian and meadow areas to some extent. All but three species in this group (California myotis, Yuma myotis and big brown bat) are ranked as moderate vulnerability.

Risks to the roost sites used by these species are the same as those discussed above for the more specialized species. Tree roosts occur in snags or large trees with decadent characteristics and are sensitive to vegetation treatments including harvest, fuels reduction treatments and fire. Alternatives 5 and 8 pose the least risk to the retention and recruitment of large trees and snags over time. Alternative 5 would provide for the retention of up to 8 of the largest snags/ acre. Alternatives 2 and 8 would retain 4/acre. Alternatives 3 and 4 pose the greatest risk to snags by potentially reducing snags to 0-2/acre. Alternatives 2 and 4 represent the greatest risk to large live trees due to fire risk from wildfire in Alternative 2 and aggressive fuels treatments in Alternative 4. Alternative 8 includes an adaptive framework for the implementation of vegetation treatments, including prescribed fire, which would reduce risk to large trees and snags. Alternative 8 also results in the greatest number of predicted acres in the large tree classes (CWHR classes 4, 5 and 6).

Roost sites in cliffs, caves, or mines may be threatened by recreational uses, hazard abatement or renewed extraction activities. No alternatives restrict recreational use of cliffs or caves where bat roosts may occur. Mines are important structures for five species: pallid bat, Brazilian free-tailed bat, fringed myotis, Yuma myotis and big brown bat. The remaining species use mines occasionally. Since it proposes the greatest level of withdrawal Alternative 2 should pose the least risk to mine roosts. Alternative 5 would withdraw KMDAs within unroaded areas > 1000 acres. Alternatives 1, 3, 4, and 7 pose the greatest risk for re-entry of old mines and disturbance caused by new mine and road construction.

## Low Elevation, Hardwood/Shrub/Grassland Group

Species that forage primarily in oak woodland, shrub and grassland habitats include: the pallid bat, Brazilian free-tailed bat and the fringed myotis. Habitat utility scores for this group must be interpreted with caution as few plots occurred in these habitat types. The pallid bat prefers low elevation areas of grassland and oak woodlands where it gleans prey from low vegetation or captures it on the ground (Hermanson and O'Shea 1983). The Brazilian free-tailed bat is an aerial forager that utilizes low elevation, open woodlands and shrub habitats, feeding predominantly on moths it catches 20-40' above the ground (Wilkins 1989). The majority of the distributions of the pallid bat and the Brazilian free-tailed bat occurs on private and non-Forest Service lands in the foothills of the Sierra Nevada. The fringed myotis is most common in oak and pinyon juniper woodlands where it forages close

to the vegetation canopy feeding primarily on beetles (O'Farrell and Studier 1980). Foothill riparian areas are particularly important for fringed myotis (CWHR 1999). Although much of the habitat for these species occurs outside the planning area, the management of oak woodlands under Forest Service ownership may play an important role in the persistence of these species in the Sierra Nevada. Open hardwood habitats are at least risk under Alternatives 4 and 7 in which a greater amount of fuels reduction treatment is allowed and predicted wildfire acreages are lower relative to other alternatives. Risks from grazing and pesticide applications are lowest in Alternatives 2 and 5.

#### Conifer/Conifer-Hardwood Group

Species that forage primarily in conifer and conifer-hardwood types include: long-eared myotis, little brown bat and long-legged myotis. Because the bulk of the plots used in vegetation projections are found in these habitat types (with the exception of montane riparian areas), the habitat utility scores for this group should be more accurate than for other species groups. Change in habitat utility values for this group may be either positive or negative, but in either case remain small.

The long-eared myotis is most common in mature forest types such as montane hardwood-conifer, montane riparian, Sierra mixed conifer and Ponderosa pine (CWHR 1999). This bat is an opportunistic forager, gleaning insects from foliage, trees, rocks, or from the ground. The long-eared myotis may also forage along paths in forested stands (Manning and Jones 1989). Of the species in this group, the long-legged myotis is the most tolerant of closed canopy forested conditions and may be found in CWHR density classes M and D. Little brown bats may be found in Ponderosa pine, Sierra mixed conifer, montane hardwood, montane hardwood-conifer, montane riparian, white fir, and up through lodgepole and red fir habitats. Stands may be of any age as long as canopy closure is less than 60% (CWHR classes S, P and M). This species is a dietary generalist that forages over water and low over vegetation. The long-legged myotis appears to be the most sensitive of this group to canopy closure. Habitats lose their value for this species when canopy closure exceeds 40%. Mature open habitats in mid-elevation conifer and conifer hardwood types are preferred. Correspondingly, since most alternatives focus on retaining and recruiting denser forest stands, the habitat utility values for this species show the greatest decline within this assessment group. Open habitats for foraging are at least risk under alternatives 4 and 7.

#### Broad Elevational Distribution and Habitat Generalist Group

The species in this group may be found in blue oak woodlands, shrub and grassland habitats, and up through Sierra mixed conifer and white fir types. In forested areas, these species may be found in open forest habitat or in denser forest that is interspersed with opening for foraging. The Yuma myotis favors the lower elevations somewhat more than the other members of this group. This species is also more closely tied to water and forages heavily on seasonally available aquatic insects (Fenton and Barclay 1980). The Yuma myotis typically feeds over water and along forested edges. Populations of this species have undergone declines in some areas as a result of pesticides, disturbance and control efforts (Fenton and

Barclay 1980, Geluso et al. 1976). Both the California myotis and the Small-footed myotis may be found in foothill woodlands and shrub communities up through open coniferous forest habitats. The California myotis will forage over water, particularly when it co-occurs with the small-footed myotis (Simpson 1993), and along forested edges taking a variety of aerial insects. The small-footed myotis forages for flying insects among trees and over water, shifting to more rocky areas when California myotis are also present (Simpson 1993). The big brown bat exhibits the broadest distribution and habitat using wet meadows, chaparral, foothill woodlands, and coniferous forests of any density and size. This species forages 15-45 feet above the ground for a variety of prey species. This common species has the most positive habitat utility values across alternatives and will likely be unaffected or benefit from the activities proposed in this EIS. This group would be most affected by the loss of open habitats for foraging and activities such as pesticide application that may affect the availability of prey. Open hardwood and conifer habitats are at least risk under Alternatives 4 and 7 in which a greater amount of fuels reduction treatment is allowed and predicted wildfire acreages are lower relative to other alternatives. Risks to riparian and meadows from grazing and pesticide applications are lowest in Alternatives 2 and 5.

Table 6: Predicted percent change in CWHR habitat suitability for bats using multiple roost types.

<b>Species</b>	<b>Alternative</b>							
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Pallid bat	-1.4	-1.6	-1.7	-0.2	-1.7	-1.4	0.0	-2.0
Brazilian free-tail bat	-1.4	-1.6	-1.7	-0.2	-1.7	-1.3	0.0	-1.9
Fringed myotis	-1.3	-1.5	-1.6	-0.3	-1.6	-1.3	0.0	-1.8
Long-eared myotis	-1.3	-0.2	-0.7	-1.2	-0.7	0.3	-0.2	-1.1
Little brown bat	-0.5	-1.5	-1.1	0.1	-0.9	-0.6	-0.3	-1.3
Long-legged myotis	-1.8	-2.1	-1.9	-0.6	-1.9	-1.4	-1.2	-2.2
Yuma myotis	-1.2	-1.4	-1.5	0.3	-1.5	-1.2	0.5	-1.7
California myotis	-0.7	-1.4	-1.2	0.7	-0.9	-0.9	0.2	-1.3
Small-footed myotis	0.2	-0.5	0.0	2.1	0.1	0.0	1.0	-0.4
Big brown bat	2.4	-0.1	0.6	3.4	1.0	0.8	1.1	0.0

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